US009091960B2

(12) **United States Patent**
Handa et al.

(10) **Patent No.: US 9,091,960 B2**
(45) **Date of Patent: Jul. 28, 2015**

(54) **DEVELOPING DEVICE FOR PREVENTING TONER LEAKAGE**

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(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **14/091,362**

(22) Filed: **Nov. 27, 2013**

(65) **Prior Publication Data**

US 2014/0153960 A1 Jun. 5, 2014

(30) **Foreign Application Priority Data**

Nov. 30, 2012 (JP) 2012-263425

(51) **Int. Cl.**
G03G 15/08 (2006.01)

(52) **U.S. Cl.**
CPC ***G03G 15/0817*** (2013.01)

(58) **Field of Classification Search**
CPC G03G 15/0817; G03G 15/0898
USPC 399/103, 105
See application file for complete search history.

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(57) **ABSTRACT**

A cartridge is configured to supply developing agent to a peripheral surface of a photosensitive drum. The cartridge includes a frame, a developing roller and first and second side seal members. The developing roller defines an axial direction, and is configured to supply developing agent in the frame to the photosensitive drum. The first side seal member is configured to seal a boundary between the frame and one end portion of the developing roller in the axial direction. The second side seal member is configured to seal a boundary between the frame and another end portion of the developing roller. The first and second side seal members define a gap therebetween in the axial direction, and the gap has a gap length smaller than a width in the axial direction of a maximum width sheet conveyed to the photosensitive drum.

8 Claims, 7 Drawing Sheets

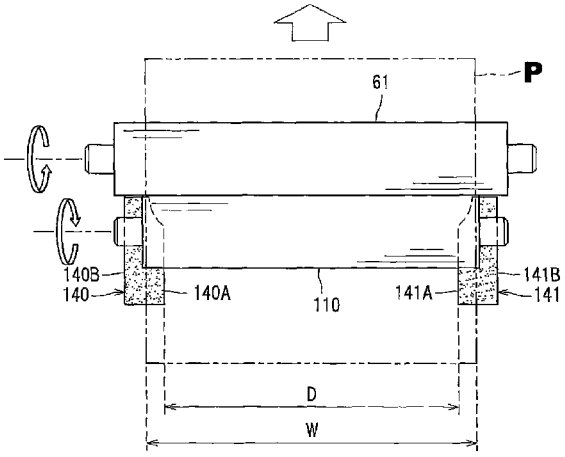


FIG.1

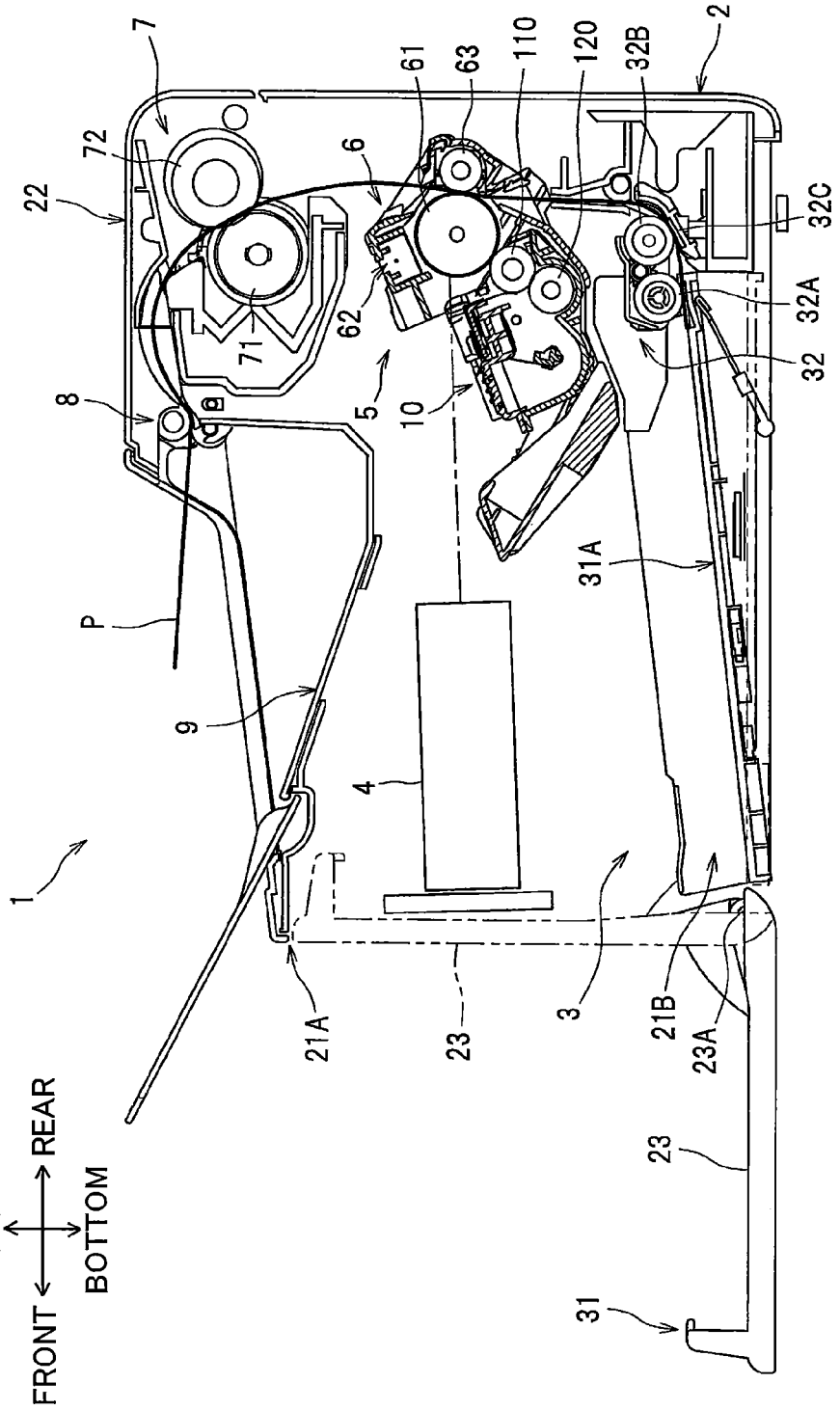

7
72
22
6
61
63
110
120
32B
2
32C
32A
32
62
71
8
5
10
31A
P
9
4
1
21A
23
3
21B
23A
23
31
TOP
BOTTOM
FRONT
REAR

FIG.2

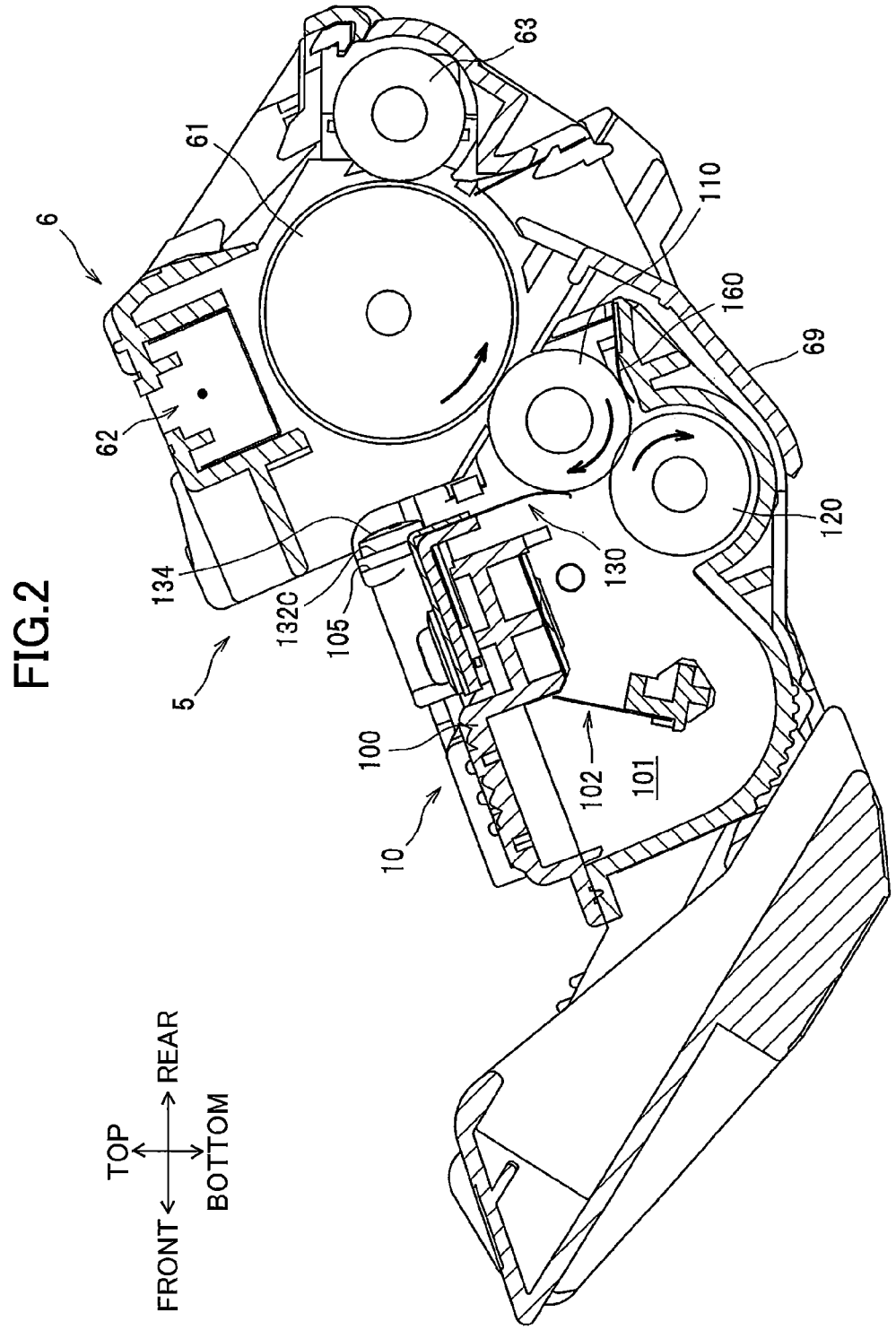

6
61
63
110
160
69
62
120
134
132C
105
130
5
100
102
101
10
TOP
BOTTOM
FRONT
REAR

FIG.3

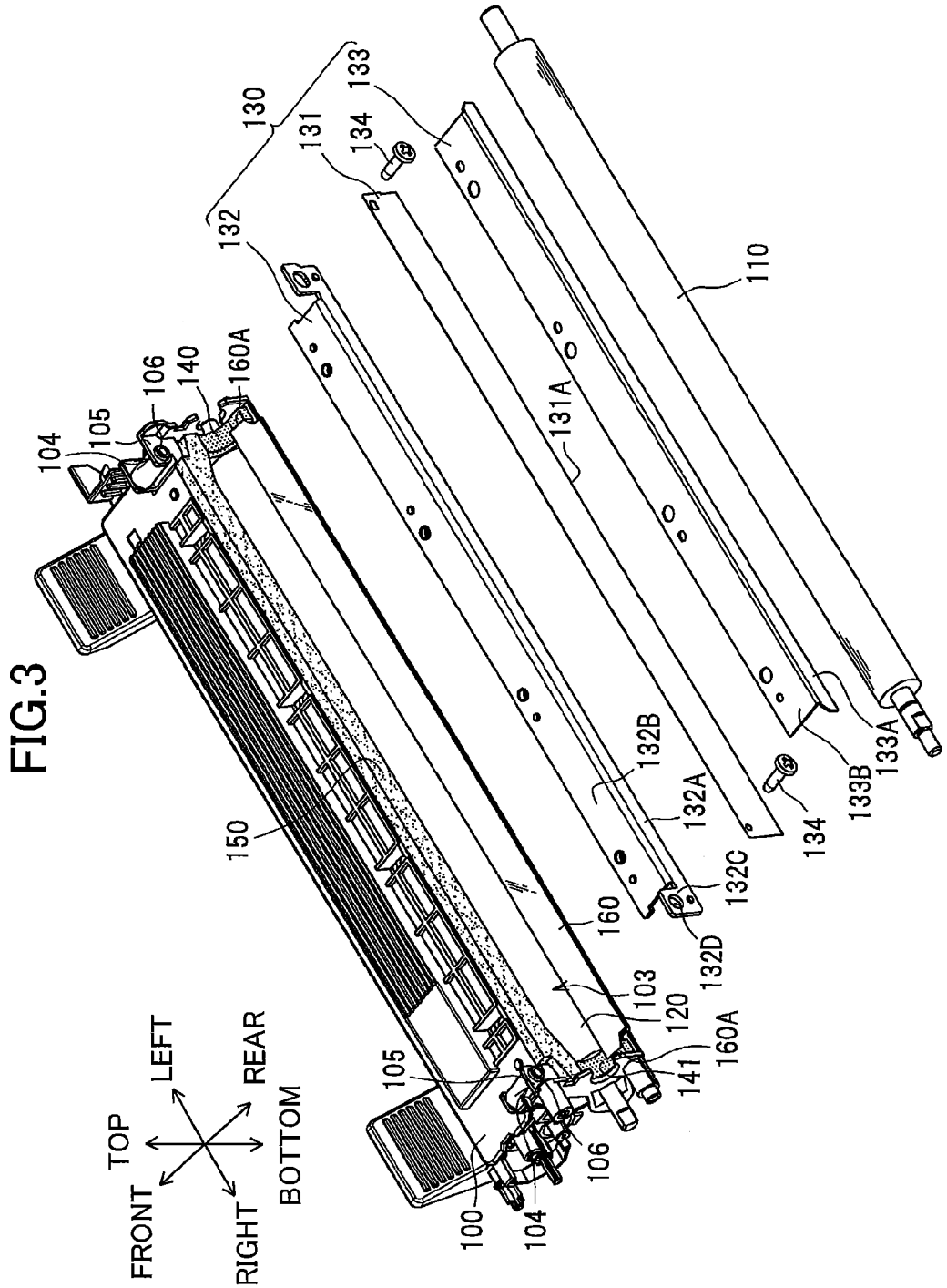

130
131
133
134
132
110
131A
106
140
160A
104
105
132B
132A
132C
134
133B
133A
150
160
132D
103
120
160A
141
105
106
100
104
TOP
LEFT
REAR
FRONT
RIGHT
BOTTOM

FIG.4

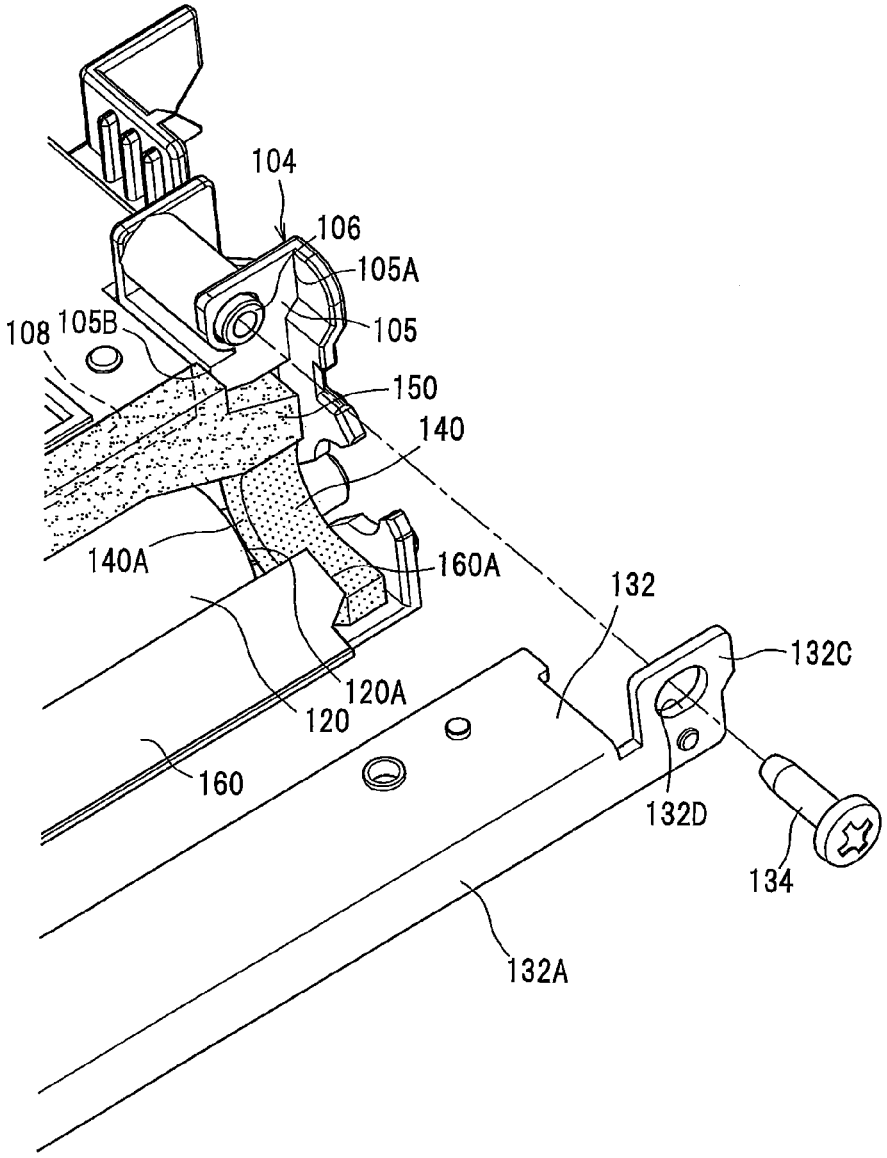

104
106
105A
108
105B
105
150
140
140A
160A
132
132C
120A
120
160
132D
134
132A

FIG.5

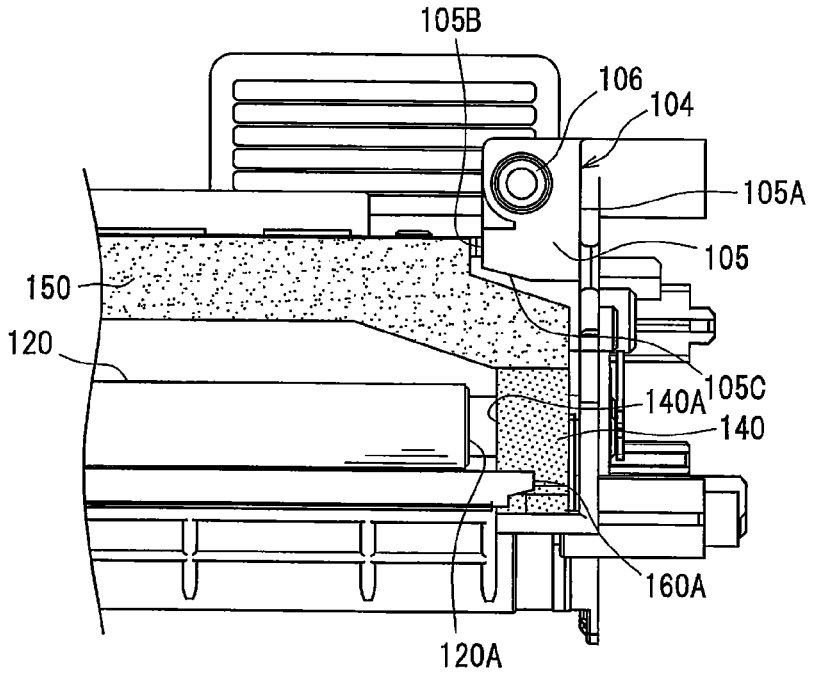


FIG.6

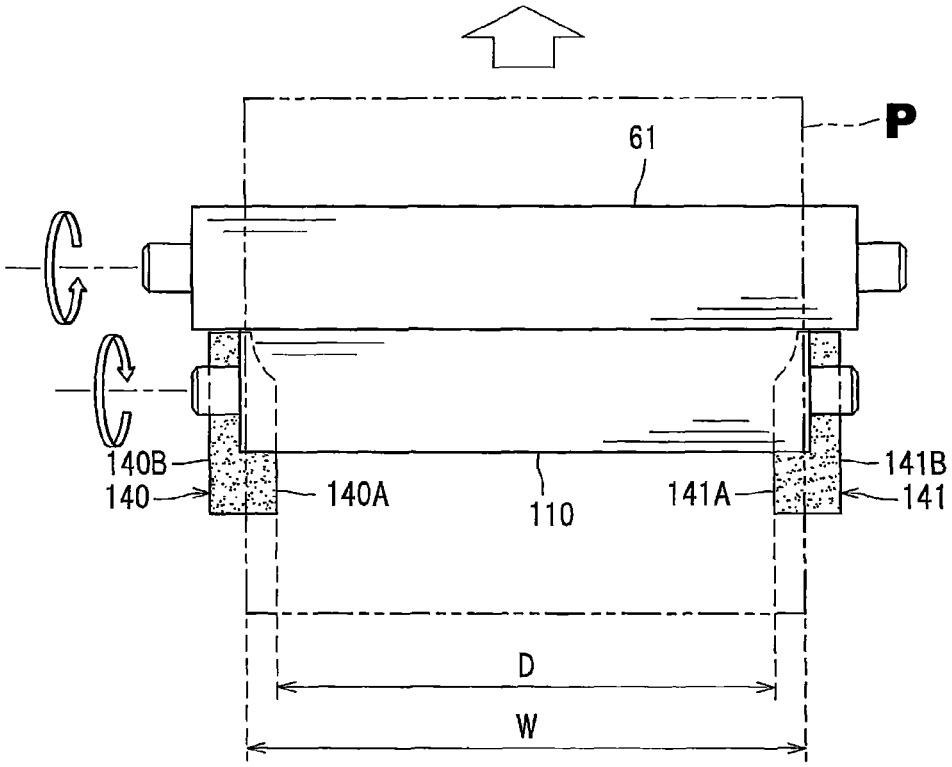
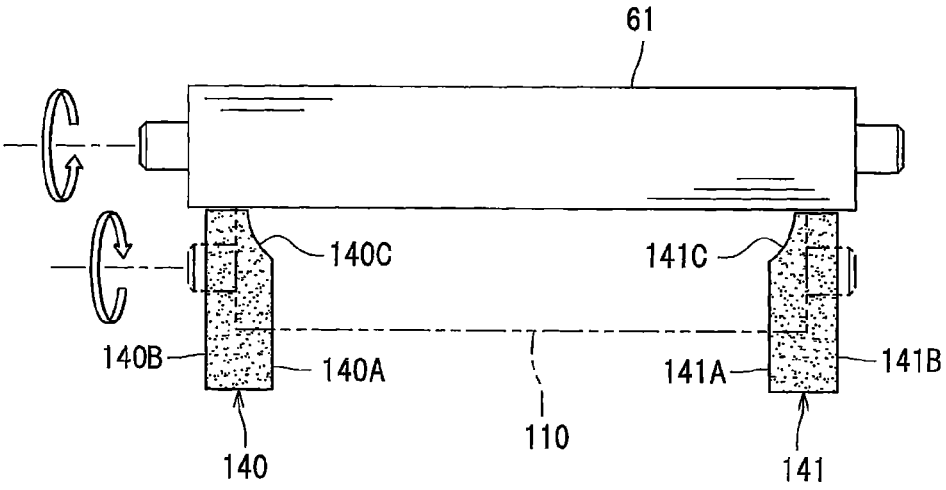


FIG.7



DEVELOPING DEVICE FOR PREVENTING TONER LEAKAGE

CROSS REFERENCE TO RELATED APPLICATION

This application claims priority from Japanese Patent Application No. 2012-263425 filed Nov. 30, 2012, the entire content of which is incorporated herein by reference.

TECHNICAL FIELD

The present invention relates to a cartridge configured to supply developing agent to a peripheral surface of a photosensitive drum in an image forming device.

BACKGROUND

Japanese Patent Application Publication No. 2006-201591 discloses a process unit as an example of the cartridge. The process unit includes a supply roller, a developing roller, a photosensitive drum, and a seal unit. The supply roller is rotatable about its axis and is configured to carry toner as developing agent on its outer peripheral surface. The developing roller is rotatable and in frictional contact with the peripheral surface of the supply roller. The photosensitive drum is rotatable and is in contact with a peripheral surface of the developing roller. The seal unit includes a right and left seal members each in frictional contact with each axial end portion of the developing roller for avoiding toner leakage therefrom. A gap between the right and left seal members is greater than a width of a maximum width sheet conveyed by the photosensitive drum.

SUMMARY

According to the cartridge disclosed in the JP publication, paper dust deposited on the sheet is deposited on the peripheral surface of the photosensitive drum, and the paper dust may be transferred onto the peripheral surface of the developing roller from the peripheral surface of the photosensitive drum. The paper dust may be entered into a toner cartridge and mixed with the toner.

Due to mixing the paper dust with the toner, electrical charge amount of the toner may be lowered during triboelectric charging between the supply roller and the developing roller. As a result, a uniform thickness of the toner layer may not be formed on the peripheral surface of the developing roller.

In view of the foregoing, it is an object of the invention to provide a cartridge capable of restraining paper dust that has been deposited on the sheet conveyed by the photosensitive drum from being mixed into developing agent.

In order to attain the above and other objects, the invention provides a cartridge for supplying developing agent to a peripheral surface of a photosensitive drum. The cartridge includes a frame, a developing roller, a first side seal member, and a second side seal member. The frame is configured to accommodate therein developing agent. The developing roller is rotatable about an axis that defines an axial direction, and is configured to supply the developing agent in the frame to the photosensitive drum. The developing roller has one end portion and another end portion in the axial direction. The first side seal member is configured to seal a boundary between the frame and the one end portion of the developing roller. The second side seal member is configured to seal a boundary between the frame and another end portion of the developing roller. The first side seal member and the second side seal member define a gap therebetween in the axial direction. The gap has a gap length smaller than a width in the axial direction of a maximum width sheet conveyed to the photosensitive drum.

BRIEF DESCRIPTION OF THE DRAWINGS

In the Drawings:

FIG. **1** is a schematic cross-sectional side view of a laser printer provided with a process cartridge according to one embodiment of the present invention;

FIG. **2** is an enlarged cross-sectional view of the process cartridge including a developing cartridge according to the embodiment;

FIG. **3** is an exploded perspective view of the developing cartridge according to the embodiment;

FIG. **4** is an enlarged partial perspective view of a left end portion of a cartridge frame in the developing cartridge according to the embodiment;

FIG. **5** is an enlarged partial rear view of the left end portion of the cartridge frame in the developing cartridge according to the embodiment;

FIG. **6** is a schematic rear view showing positional relationship among a photosensitive drum, a developing roller, and seal members in the process cartridge according to the embodiment; and

FIG. **7** is a schematic rear view particularly showing notched portions of the side seal members in the process cartridge according to the embodiment.

DETAILED DESCRIPTION

A cartridge according to one embodiment of the present invention will be described with reference to FIGS. **1** through **7**. The cartridge according to the embodiment constitutes a process cartridge **5** used in a laser printer **1** shown in FIG. **1**. The terms "upward", "downward", "upper", "lower", "above", "below", "beneath", "right", "left", "front", "rear" and the like will be used throughout the description assuming that the laser printer **1** is disposed in an orientation in which it is intended to be used. In use, the laser printer **1** is disposed as shown in FIG. **1** in which left side and right of FIG. **1** will be referred to as a "front side" and a "rear side" respectively. Further, a direction perpendicular to frontward/rearward direction will be referred to as "lateral direction" or "leftward/rightward direction", and a direction perpendicular to the frontward/rearward direction and to the lateral direction will be referred to as "vertical direction".

[Overall Structure of the Laser Printer]

As shown in FIG. **1**, the laser printer **1** includes a main casing **2**, a feeder unit **3**, a scanner unit **4**, a process cartridge **5** configured to form a toner image on a sheet P, and a fixing unit **7** for thermally fixing the toner image to the sheet P.

The main casing **2** includes a top cover **22** and a front cover **23**, and has a front end formed with an opening **21**A for attachment and detachment of the process cartridge **5**. Further, a sheet insertion portion **21**B is provided at a lower portion of the opening **21**A for inserting a sheet P.

The front cover **23** is pivotally movably supported to a lower front end portion of the main casing **2** by a pivot shaft **23**A, such that the front cover **23** is movable to an upstanding position closing the opening **21**A as indicated by two dotted chain line and to a lying position opening the opening **21**A as indicated by a solid line.

The feeder unit **3** is positioned at a lower interior space of the main casing **2**, and includes a sheet supply tray **31** for

accommodating a stack of sheets P, and a sheet supply mechanism **32** configured to supply the sheet in the sheet supply tray **31**. The sheet supply tray **31** is constituted by a sheet stand **31**A positioned at the lower portion of the main casing **2** and the front cover **23** opened in continuous manner with the sheet stand **31**A.

The sheet supply mechanism **32** includes a sheet supply roller **32**A, a separation roller **32**B, and a separation pad **32**C. The sheet supply roller **32**A is positioned upward of a rear end portion of the sheet stand **31**A. The separation roller **32**B is positioned downstream of the sheet supply roller **32**A in a sheet feeding direction. The separation pad **32**C is positioned in confrontation with the separation roller **32**B such that the sheet P is nipped therebetween.

In the feeder unit **3**, the sheet P mounted on the upper surface of the lying front cover **23** and on the sheet stand **31**A is supplied toward the separation roller **32**B by the rotation of the sheet supply roller **32**A. Then, an uppermost sheet P is separated from the remaining sheets of the sheet stack by the separation roller **32**B and the separation pad **32**C, and is supplied toward the process cartridge **5**.

The scanner unit **4** is positioned at a front side of the inner space of the main casing **2**, and includes a laser emitting portion, a polygon mirror, a lens and a reflection mirror those not shown. The scanner unit **4** is configured to emit laser beam to an outer peripheral surface of a photosensitive drum **61** (described later) with high speed scanning.

The process cartridge **5** is positioned above the sheet supply mechanism **32** at a rear side of and a widthwise center of the internal space of the main casing **2**. The process cartridge **5** can be detached from and attached to the main casing **2** through the opening **21**A. As shown in FIG. **2**, the process cartridge **5** includes a drum unit **6** and a developing cartridge **10** as a cartridge.

The drum unit **6** includes a drum frame **69**, the photosensitive drum **61**, a charger **62** and a transfer roller **63** those provided in the drum frame **69**. The developing cartridge **10** is detachably attachable to the drum unit **6**, and includes a frame **100**, a developing roller **110**, a supply roller **120**, and a blade unit **130** for regulating a thickness of a layer of developing agent.

The developing roller **110** is configured to carry developing agent (toner) on its peripheral surface. The developing roller **110** is rotatable about its axis and is supported to the frame **100**. The supply roller **120** is configured to supply toner carried on its peripheral surface to the peripheral surface of the developing roller **110**. The supply roller **120** is positioned diagonally frontward and downward of the developing roller **110** in an accommodated state of the process cartridge **5** to the main casing **2**. The supply roller **120** extends in a direction parallel to an axial direction of the developing roller **110**.

The frame **100** defines a toner chamber **101** in which an agitator **102** is rotatably provided for agitating toners accommodated in the toner chamber **101**. After the toner in the toner chamber **101** is subjected to agitation by the agitator **102**, the toner is supplied from the peripheral surface of the supply roller **120** to the peripheral surface of the developing roller **110**. In this case, the toner is tribocharged with positive polarity between the peripheral surfaces of the supply roller **120** and the developing roller **110**. Then, the toner carried on the peripheral surface of the developing roller **110** is entered into a space between the blade unit **130** and the peripheral surface of the developing roller **110** while being subjected to triboelectric charging in accordance with the rotation of the developing roller **110**. Thus, the toner layer having a uniform thickness is carried on the peripheral surface of the developing roller **110**.

In the drum unit **6**, after the peripheral surface of the rotating photosensitive drum **61** is uniformly charged by the charger **62**, the surface of the photosensitive drum **61** is exposed to laser beam with high speed scanning by the scanner unit **4**. Thus, electric potential of the exposed region of the photosensitive drum **61** is lowered to provide an electrostatic latent image based on image data on the peripheral surface of the photosensitive drum **61**.

Accordingly, toner image corresponding to the electrostatic latent image is formed on the peripheral surface of the photosensitive drum **61** by supplying toner from the developing roller **110**. Thereafter, the toner image on the photosensitive drum **61** is transferred onto the sheet P when the sheet P passes through a gap between the photosensitive drum **61** and the transfer roller **63** to which a transfer bias is applied.

The fixing unit **7** is positioned at an upper rear portion of the internal space of the main casing **2** and above the process cartridge **5**, and includes a heat roller **71** and a pressure roller **72**. The heat roller **71** is adapted to heat the sheet P, and has an internal space provided with a heat source such as a halogen lamp (not shown). The pressure roller **72** is positioned diagonally rearward and above the heat roller **71** and adapted to nip the sheet P in cooperation with the heat roller **71**. A discharge roller **8** is positioned downstream of the fixing unit **7** in the sheet feeding direction, and a discharge tray **9** is provided at an upper portion of the main casing **2**.

The toner image formed on the sheet P is thermally fixed to the sheet P when the sheet P passes through a gap between the heat roller **71** and the pressure roller **72**. The sheet P is then conveyed to the discharge tray **9** by the discharge roller **8**.

[Detailed Structure of the Developing Cartridge]

Details of the frame **100** and the blade unit **130** of the developing cartridge **10** will be described. The developing cartridge **10** constitutes the process cartridge **5**. As shown in FIG. **3**, the frame **100** has a rear side wall formed with a rectangular opening **103**, and the developing roller **110** and the blade unit **130** are attached to the frame **100** such that the developing roller **110** and the blade unit **130** close the opening **103**. A first side seal member **140**, a second side seal member **141**, an upper seal member **150**, and a film member **160** are provided around a rectangular perimeter of the opening **103** to prevent the toner in the frame **100** from being leaked out of the frame **100**.

A fixing portion **104** is provided at each upper end portion of an upper edge of the opening **103** for fixing the blade unit **130**. Each fixing portion **104** has a support surface **105** facing rearward. A boss **106** formed with a female thread hole is provided at the support surface **105**. Further, an attachment surface **108** is provided at the upper edge portion of the opening **103** and at a position frontward of the fixing portion **104** in frontward/rearward direction of the frame **100** for fixing the upper seal member **150** to the attachment surface **108** as shown in FIG. **4**. The attachment surface **108** faces rearward and extends in leftward/rightward direction of the frame **100** to a portion adjacent to and above a portion where the first and second side seal members **140**, **141** is provided.

The blade unit **130** includes a blade body **131**, a blade holder **132**, and a reinforcing plate **133**. The blade body **131** is formed of a metal plate such as a stainless steel plate, and has a free end portion functioning as a contact portion **131**A. The free end portion of the contact portion **131**A is bent or curved (see FIG. **2**) and is in confrontation with and in contact with the peripheral surface of the developing roller **110**. Because of this curved contact portion **131**A, the blade body **131** regulates a thickness of the toner layer formed on the developing roller **110** into a uniform thickness.

The blade holder **132** includes a blade support section **132**A for supporting the blade body **131**, a reinforced section **132**B to which the reinforcing plate **133** is attached, and a pair of attachment sections **132**C to be attached to the pair of fixing portions **104** of the frame **100**. The reinforced section **132**B is bent frontward at substantially right angle with respect to the blade support section **132**A from an upper edge thereof. Each attachment section **132**C is provided at each longitudinal end portion of the blade holder **132** such that each attachment section **132**C can be superposed with each support surface **105** of each fixing portion **104** in frontward/rearward direction. Each attachment section **132**C protrudes upward from each longitudinal end portion of the blade support section **132**A. The longitudinal end portion is an end portion of the blade support section **132**A in rightward/leftward direction. Further, each attachment section **132**C is formed with a through-hole **132**D penetrating the same in frontward/rearward direction.

The reinforcing plate **133** includes a nip section **133**A and a fixing section **133**B. The nip section **133**A is adapted to nip the blade body **131** in cooperation with the blade support section **132**A of the blade holder **132**. The fixing section **133**B is adapted to be fixed to the reinforced section **132**B of the blade holder **132**. The nip section **133**A is bent downward at substantially right angle with respect to the fixing section **133**B from a rear edge thereof.

The blade body **131** is nipped between the blade support section **132**A of the blade holder **132** and the nip section **133**A of the reinforcing plate **133**, and the reinforced section **132**B of the blade holder **132** and the fixing section **133**B of the reinforcing plate **133** are fixed together by threads (not shown), to thus provide an integral blade unit **130**. As shown in FIG. **4**, each thread **134** extends through each through-hole **132**D of the attachment section **132**C of the blade holder **132**, and the thread **134** is threadingly engaged with each female thread of the boss **106** at the fixing portion **104**. Thus, the blade unit **130** is fixed to the frame **100**.

The first and second side seal members **140**, **141** are adapted to perform sealing between the frame **100** and axial end portions of the developing roller **110**. Each of the side seal members **140**, **141** is arcuate in shape in conformance with an outer peripheral shape of the developing roller **110**. Each of the side seal members **140**, **141** includes a base layer attached to the frame **100** and a sliding layer formed on the base layer and in sliding contact with the peripheral surface of the developing roller **110**. The base layer is formed of a sponge member made from urethane foam or a silicone sponge. The sliding layer is formed of a woven fabric for trapping the toner, and has a fluffed surface. PTFE (polytetrafluoroethylene) fiber, PET (polyethylene terephthalate) fiber, acrylic fiber, and nylon fiber are available as a material of the sliding layer.

The upper seal member **150** is adapted to perform sealing between the frame **100** and the blade unit **130** along a length of the blade unit **130** and is formed of a sponge member such as a silicon sponge or a urethane foam. The upper seal member **150** is adhesively bonded to the attachment surface **108** of the frame **100**, such that the upper seal member **150** is nipped between the attachment surface **108** and the blade support section **132**A of the blade holder **132**.

The film **160** is formed of a resin material such as PET, acrylic resin and fluorine resin. The film **160** extends in the axial direction of the developing roller **110**. The film **160** has a base end portion attached to eh frame **100**, and a free end portion directing toward an internal space of the frame **100** and in sliding contact with the peripheral surface of the developing roller **110**. The film **160** is positioned below the developing roller **110** and upstream of the blade unit **130** in the rotational direction of the developing roller **110**.

[Details of Lateral End Portions of the Developing Cartridge]

Lateral end portions of the developing cartridge **10** are end portions thereof in rightward/leftward direction. Since the right end portion and left end portion of the developing cartridge **10** are symmetrical with each other, only the left end portion will be described.

As shown in FIGS. **3**, **4** and **5**, the support surface **105** of the fixing portion **104** extends in vertical direction and faces to the developing roller **110**. Further, the support surface **105** extends approximately parallel to the attachment surface **108** of the frame **100**. The boss **106** formed with the female thread hole protrudes rearward from the support surface **105**. Further, the support surface **105** is positioned rearward of the attachment surface **108** in the frontward/rearward direction. That is, the support surface **105** is closer to the developing roller **110** than the attachment surface **108** to the developing roller **110** in frontward/rearward direction.

The support surface **105** of the frame **100** has an outer edge **105**A and an inner edge **105**B in the lateral direction of the frame **100** (in the longitudinal direction of the blade unit **130**), and the first side seal member **140** has an inner edge **140**A and an outer edge **140**B in the lateral direction (in the axial direction of the developing roller **110**). The outer edge **105**A is positioned outward of the inner edge **140**A in the lateral direction. Further, the inner edge **105**B of the support surface **105** is positioned outside of an image forming region in the axial direction of the developing roller **110**, and inward of the inner edge **140**A of the first side seal member **140**.

More specifically, the inner edge **105**B of the support surface **105** is positioned between an axial end surface **120**A of the supply roller **120** and the inner edge **140**A of the first side seal member **140**. Further, the inner edge **105**B is positioned inward of a longitudinal end **160**A of the film **160** in the longitudinal direction thereof.

Further, the support surface **105** has an inclined lower edge **105**C connected to the inner edge **105**B. The inclined lower edge **105**C is inclined so as to gradually away from an edge of the contact portion **131**A toward a longitudinal center of the blade unit **130**.

[Positions of First and Second Side Seal Members]

The first and second side seal members **140**, **141** will be described in detail with reference to FIGS. **6** and **7**. Incidentally, FIGS. **6** and **7** are schematic rear views as viewed from a rear side in FIG. **3**. The first side seal member **140** that seals a boundary between the frame **100** and one axial end portion of the developing roller **110** is positioned at left side in FIGS. **5** and **7**, and the second side seal member **141** that seals a boundary between the frame **100** and another axial end portion of the developing roller **110** is positioned at right side in FIGS. **5** and **7**.

As shown in FIG. **6**, one end portion of the developing roller **110** that is in rolling contact with the photosensitive drum **61** is in rolling contact with an inner surface of the first seal member **140**, and another end portion of the developing roller **110** is in rolling contact with an inner surface of the second seal member **141**. The developing roller **110** has one end face positioned between the inner edge **140**A and the outer edge **140**B of the first side seal member **140** in the axial direction of the developing roller **110**, i.e., in a widthwise direction of the first side seal member **140**. Similarly, the developing roller **110** has another end face positioned between an inner edge **141**A and an outer edge **141**B of the second side seal member **141** in the widthwise direction of the second side seal member **141**.

A distance D between the inner edge **140**A of the first side seal member **140** and the inner edge **141**A of the second side seal member **141** is smaller than a width W in lateral direction of a maximum size sheet P such as A4 size sheet to be conveyed by the photosensitive drum **61**. That is, widthwise edges of the maximum size sheet P in the widthwise direction is overlapped with the first side seal member **140** and the second side seal member **141**, respectively. More specifically, the first side seal member **140** is positioned such that one widthwise edge of A4 sheet is positioned at a center portion between the inner edge **140**A and the outer edge **140**B. Similarly, the second side seal member **141** is positioned such that another widthwise edge of A4 sheet is positioned at a center portion between the inner edge **141**A and the outer edge **141**B.

Here, the sheet P is bilaterally symmetric with respect to a center in the axial direction of the developing roller **110** and the photosensitive drum **61**. Further, the first and second side seal members **140**, **141** are bilaterally symmetric with each other with respect to the center. More specifically, the first and second side seal members **140**, **141** are plane symmetry with respect to an imaginary plane perpendicular to the center of the developing roller **110** in the axial direction and extending in a direction perpendicular to the axial direction. Further, in a state where the process cartridge **5** is accommodated in the main casing **2**, a center of an image forming region of the photosensitive drum **61** in the axial direction thereof is on the imaginary plane. That is, the center of the image forming region of the photosensitive drum **61** in the lateral direction is coincident with the center of the developing roller **110** in the axial direction. Further, the sheet P is set and conveyed by the feeder unit **3** such that a widthwise center of the sheet P is positioned coincident with the imaginary plane.

Further, as shown in FIG. **7**, the first and second side seal members **140**, **141** have notched portions **140**C, **141**C, respectively for trapping paper dust thereat. The notched portion **140**C is located at an upstream side of the first side seal member **140** in the rotating direction of the developing roller **110**, and is notched in arcuate shape at the inner edge **140**A. Similarly, the notched portion **141**C is located at an upstream side of the second side seal member **141** in the rotating direction of the developing roller **110**, and is notched in arcuate shape at the inner edge **141**A. These notched portions **140**C, **141**C are shaped such that the each curvature is directed outward as the curvature approaches the upstream end in the rotational direction. As shown in FIG. **5**, the longitudinal end **160**A of the film **160** is overlapped with the first side seal member **140** in rightward/leftward direction, e.g., a portion adjacent to the notched portion **140**C.

[Function]

In the developing cartridge **10** thus constructed, since the support surface **105** is positioned rearward of the attachment surface **108** to which the upper seal member **150** is attached, the upper seal member **150** can be nipped with a desirable compressed state between the blade support section **132**A and the attachment surface **108** of the frame **10**, and the blade support section **132**A can be fixed to the support surface **105** with a sufficient contacting state therewith without any floating of the longitudinal end portion of the blade support section **132**A.

Here, the inner edge **105**B of the support surface **105** is positioned between the axial end **120**A of the supply roller **120** and the inner edge **140**A of the side seal member **140**. In other words, the support surface **105** is positioned to superpose with inner edge **140**A of the side seal member **140** that performs sealing between the frame **100** and the axial end portion of the developing roller **110** in the longitudinal direction of the blade unit **130**. Therefore, the contact portion **131**A of the blade body **131** can be in contact with the peripheral surface of the developing roller **110** with a sufficient contacting pressure at a position adjacent to the inner edge **140**A of the side seal member **140**. Consequently, sufficient triboelectric charging to the toner occurs at a position between the peripheral surface of the developing roller **110** and the contact portion **131**A of the blade body **131**, which can restrain toner leakage from a boundary between each axial end portion of the developing roller **110** and the blade body **131** of the blade unit **130**.

Further, since the inner edge **105**B of the support surface **105** is positioned outward of the axial end of the supply roller **120**, toner can be sufficiently supplied from the supply roller **120** to the developing roller **110** even at the axial end portion **120**A of the supply roller **120**.

Further, the inclined lower edge **105**C is inclined away from the contact portion **131**A in a direction toward the longitudinal center of the blade unit **130**. Therefore, at the axial end portions of the developing roller **110**, contacting pressure of the contact portion **131**A with respect to the peripheral surface of the developing roller **110** can be gradually reduced without abrupt change toward the longitudinal center of the blade unit **130**. Consequently, toner leakage out of the boundary between the blade body **131** and the axial end portions of the developing roller **110** can be stably restrained.

[Collection of Paper Dust]

As shown in FIG. **6**, in case of conveying the maximum width sheet, i.e., A4 size sheet P to the photosensitive drum **61**, paper dust adhered onto one widthwise end portion of the sheet P is transferred onto the one peripheral end portion of the developing roller **110** through the peripheral surface of the photosensitive drum **61**. The paper dust on the one peripheral end portion of the developing roller **110** is then trapped and collected by the first side seal member **140** in accordance with the rotation of the developing roller **110**. In this case, major part of the paper dust is trapped at a surface of the notched portion **140**C, i.e., within the thickness of the notched portion **140**C of the first side seal member **140**.

Similarly, paper dust adhered onto the other widthwise end portion of the sheet P is transferred onto the other peripheral end portion of the developing roller **110** through the peripheral surface of the photosensitive drum **61**. The paper dust on the other peripheral end portion of the developing roller **110** is then trapped and collected by the second side seal member **141** in accordance with the rotation of the developing roller **110**. In this case, major part of the paper dust is trapped at a surface of the notched portion **141**C, i.e., within the thickness of the notched portion **141**C of the second side seal member **141**.

Since the notched portion **140**C is formed at the upstream side of the first side seal member **140**, a pressure exerted on the first side seal member **140** by the developing roller **110** is reduced around the notched portion **140**C and thus the paper dust on the other peripheral end portion of the developing roller **110** is trapped and collected by the first side seal member **140**. Similarly, since the notched portion **141**C is formed at the upstream side of the second side seal member **141**, a pressure exerted on the second side seal member **141** by the developing roller **110** is reduced around the notched portion **141**C and thus the paper dust on the other peripheral end portion of the developing roller **110** is trapped and collected by the second side seal member **141**.

As described above, according to the cartridge of the above-described embodiment, in case of conveying the maximum width sheet, i.e., A4 size sheet P to the photosensitive drum **61**, paper dust adhered onto each widthwise end portion

of the sheet P can be trapped by each of the first and second side seal members **140**, **141**. Therefore, mixing of the paper dust into the toner contained in the frame **100** can be restrained or avoided.

Various modifications are conceivable. For example, each widthwise edge of a maximum width sheet can be positioned outward of the first side seal member and the second side seal member in the widthwise direction of the sheet. Further, the cartridge according to the present invention can be applied not only to the monochromatic printer shown in FIG. **1**, but also to a color printer, a copying machine, and a multi-function device. The frame **100** of the developing cartridge **10** accommodates therein the toner. The developing cartridge may detachably receive a toner cartridge for accommodating toner therein.

While the invention has been described in detail with reference to the above-described embodiments thereof, it would be apparent to those skilled in the art that various changes and modifications may be made therein without departing from the spirit of the invention.

What is claimed is:

1. A cartridge for supplying developing agent to a peripheral surface of a photosensitive drum comprising:

a frame;

a developing roller rotatable about an axis that defines an axial direction, and configured to supply developing agent in the frame to the photosensitive drum, the developing roller having one end portion and another end portion in the axial direction;

a first side seal member configured to seal a boundary between the frame and the one end portion of the developing roller; and

a second side seal member configured to seal a boundary between the frame and the another end portion of the developing roller, the first side seal member and the second side seal member defining a gap therebetween in the axial direction, and the gap having a gap length smaller than a width in the axial direction of a maximum width sheet conveyed to the photosensitive drum,

wherein the first side seal member is positioned such that one widthwise edge of the maximum width sheet in the axial direction is positioned at a center portion of the first side seal member in the axial direction, and the second side seal member is positioned such that another widthwise edge of the maximum width sheet in the axial direction is positioned at a center portion of the second side seal member in the axial direction.

2. The cartridge as claimed in claim **1**, wherein the first side seal member and the second side seal member have inner edges in the axial direction, and have upstream end portions in a rotational direction of the developing roller, the inner edges being formed with notched portions configured to trap paper dust, the notched portions being formed at the upstream end portions of the first side seal member and the second side seal member, respectively.

3. The cartridge as claimed in claim **2**, wherein the notched portions are notched in arcuate shape, the notched portions having a curvature directed outward as the curvature approaches the upstream end portions of the first side seal member and the second side seal member.

4. The cartridge as claimed in claim **1**,

wherein the developing roller has a peripheral surface;

wherein the cartridge further comprises an elongated blade unit in contact with the peripheral surface and configured to regulate a thickness of a layer of the developing agent supplied to the peripheral surface, the blade unit having longitudinal end portions;

wherein the frame includes support surfaces to which the longitudinal end portions are fixed, the support surfaces facing the developing roller, and having inner edges in the axial direction; and

wherein the first side seal member and the second side seal member have inner edges in the axial direction, the inner edges of the support surfaces being positioned inward of the inner edges of the first side seal member and the second side seal member.

5. A cartridge for supplying developing agent to a peripheral surface of a photosensitive drum comprising:

a frame;

a developing roller rotatable about an axis that defines an axial direction, and configured to supply developing agent in the frame to the photosensitive drum, the developing roller having one end portion and another end portion in the axial direction and a peripheral surface;

a first side seal member configured to seal a boundary between the frame and the one end portion of the developing roller;

a second side seal member configured to seal a boundary between the frame and the another end portion of the developing roller, the first side seal member and the second side seal member defining a gap therebetween in the axial direction, and the gap having a gap length smaller than a width in the axial direction of a maximum width sheet conveyed to the photosensitive drum; and

an elongated blade unit in contact with the peripheral surface and configured to regulate a thickness of a layer of the developing agent supplied to the peripheral surface, the blade unit having longitudinal end portions,

wherein the frame includes support surfaces to which the longitudinal end portions are fixed, the support surfaces facing the developing roller, and having inner edges in the axial direction; and

wherein the first side seal member and the second side seal member have inner edges in the axial direction, the inner edges of the support surfaces being positioned inward of the inner edges of the first side seal member and the second side seal member.

6. The cartridge as claimed in claim **5**, wherein the first side seal member and the second side seal member have inner edges in the axial direction, and have upstream end portions in a rotational direction of the developing roller, the inner edges being formed with notched portions configured to trap paper dust, the notched portions being formed at the upstream end portions of the first side seal member and the second side seal member, respectively.

7. The cartridge as claimed in claim **6**, wherein the notched portions are notched in arcuate shape, the notched portions having a curvature directed outward as the curvature approaches the upstream end portions of the first side seal member and the second side seal member.

8. The cartridge as claimed in claim **5**, wherein the first side seal member is positioned such that one widthwise edge of the maximum width sheet in the axial direction is positioned at a center portion of the first side seal member in the axial direction, and the second side seal member is positioned such that another widthwise edge of the maximum width sheet in the axial direction is positioned at a center portion of the second side seal member in the axial direction.

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